GE 29003 (5)

PATENT SPECIFICATION 1,110,027

DRAWINGS ATTACHED.

1,110,027

Date of Application and filing Complete Specification:
22 Oct., 1965. No. 44901/65.

Application made in Germany (No. G41843 XII/47c) on 23 Oct., 1964.

Complete Specification Published: 18 April, 1968.

Index at Acceptance:—F2 U(554, 558, 566).

Int. Cl.:—F 16 d 3/74.

COMPLETE SPECIFICATION.

Resilient Coupling Element.

We, GOETZEWERKE FRIEDRICH GOETZE AKTIENGESELLSCHAFT, a Body Corporate organised and existing under the laws of the Federal Republic of Germany, of 5673 Burscheid bei Koln, Dusseldorf, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a resilient coupling element for the transmission of torque, particularly but not exclusively intended for the steering transmission of an automobile vehicle.

It is known to incorporate in rods rotatable through predetermined angles, in particular the steering columns of automobile vehicles, torsionally resistant coupling elements which take up shocks and reduce the stresses on the bearings during excessive angular movements of the columns.

For this purpose, a coupling element used in an automobile vehicle should be as resilient as possible in the mean position in which the steering column is not subjected to any torsion, whereas with a rotation through about 5° onwards its rigidity should increase extremely rapidly, so that the coupling provides a substantially rigid connection for an angle of rotation of say 7°.

The invention arises from appreciation of the fact that in a known coupling comprising metal bushings connected by rubber members the required characteristic can be obtained by suitably shaping the rubber members and the metal bushings.

In accordance with the present invention there is provided a resilient coupling element for the transmission of torque comprising a number of metal bushings for connection to the parts to be coupled and rubber members alternating with the metal bushings, the bushings having bulges extending towards each other and the rubber members having radially-extending cavities closed at their radially inner and outer ends, the walls of the cavities conforming to the surfaces of the bulges of the bushings in a region midway between the inner and outer ends of the cavities whereby the cavities are constricted in this region. The cavities make the coupling element very soft during the initial rotation from its mean position. The angle up to which this condition is maintained is determined by the dimensions of the cavities and in particular by the width of the constricted part of the cavity.

From the instant at which the walls of the cavity come into contact due to the rotation of the coupled parts, the torsional stiffness of the rubber member rises steeply with the rotation, thereby ensuring the required safety and strength of the transmission for larger angles of rotation.

If following rotation of the steering wheel through 5°, for example, the torsional stiffness of the rubber member increases very steeply owing to the rubber on the sides of the constriction coming into contact, but not to the extent that it is equivalent in torsional stiffness to a solid metal connection, then upon further compression of the rubber that covers the bulges, e.g. upon a 7° rotation of the steering wheel, the torsional stiffness becomes substantially equivalent to that of a rigid connection.

The metal parts of the coupling element are advantageously so rounded off that forces of tension and compression stresses are distributed. Moreover, the inner and outer periphery of the cross-section of the cavity may be rounded off to a semicircular shape, the radius of the radially outer peripheral arc preferably being larger

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than that of the radially inner peripheral arc.

Formation of the coupling in accordance with the invention provides, over a wide range of rotation, a connection which is initially soft and then becomes firm, since in addition to the dimensions of the cavity the thickness of the cross section of the rubber between the cavity and the adjoining metal bushings and the number of pairs of rubber members and metal bushings can be selected to suit the particular requirements.

The single Figure of the accompanying drawing is a cross-section through a coupling element according to the invention for incorporation in the steering column of an automobile vehicle, the coupling element comprising four metal bushings alternating with four rubber members.

In the steering column 1 is mounted a coupling element made up of metal bushings or sleeves 2 and rubber members 3, the sleeves 2 abutting the members 3 loosely, although they may if desired be firmly connected to them. Through the metal sleeves 2 pass bolts 4 for connection to the two parts of the steering column to be coupled. In each rubber member 3 is formed a cavity 5 which extends through the rubber member parallel to the coupling axis. The radially outer periphery 6 of the cross-section of the cavity is a circular arc of larger radius than the arc 7 forming the radially inner periphery. At the centre of its radial length the cavity 5 is constricted. The metal sleeves 2 have on each side projections or bulges 8 which are accommodated in recesses in the adjoining rubber members 3. The walls of the cavities conform to the bulges 8 and thereby form the constrictions in the cavities. The surfaces bonding each cavity are symmetrical about a radius of the coupling.

Upon rotation of the coupling there are three different operating conditions, with smooth transition from one to the next. In the first operating condition the coupling is very soft, owing to the cavities 5. When, upon further rotation, the rubber on the two sides of the cavities comes into contact, the second operating condition arises in which the angular stiffness is greater, being dependent on the softness of the rubber selected, and this condition lasts over an angle determined by the thickness of the rubber on the sides of the cavities. Upon further rotation the high compression of the rubber between the bulged parts 8 provides the third operating condition in which the coupling is substantially rigid.

WHAT WE CLAIM IS:—

1. A resilient coupling element for the transmission of torque comprising a number of metal bushings for connection to the parts to be coupled and rubber members alternating with the metal bushings, the bushings having bulges extending towards each other and the rubber members having radially-extending cavities closed at their radially inner and outer ends, the walls of the cavities conforming to the surfaces of the bulges of the bushings in a region midway between the inner and outer ends of the cavities whereby the cavities are constricted in this region.

2. A resilient coupling element as claimed in claim 1 in which the surfaces bounding each cavity are symmetrical about a radius of the coupling.

3. A resilient coupling element as claimed in claim 1 or 2 in which the inner and outer ends of each cavity are formed by circular arcs and the radius of the outer end is larger than that of the inner end.

4. A resilient coupling element substantially as described with reference to the accompanying drawing.

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Printed for Her Majesty's Stationery Office by Burgess & Son (Abingdon), Ltd.—1968.
Published at The Patent Office, 25 Southampton Buildings, London, W.C.2,
from which copies may be obtained.

1110027 COMPLETE SPECIFICATION

1 SHEET *This drawing is a reproduction of the Original on a reduced scale*